

## When Do Pallid Sturgeon Spawn?

### Information Sources:

Pat Braaten, USGS  
Herb Bollig, USFWS  
Aaron Delonay, USGS  
Wyatt Doyle, USFWS  
Dave Herzog, MDC  
Rob Holm, FWS  
Diana Papoulias, USGS  
Kerry Reeves, U of MO  
Darrel Snyder, CSU

### Presenter:

David Galat  
USGS, Cooperative Research Units  
Department of Fisheries & Wildlife Sciences  
University of Missouri, Columbia, MO  
galatd@missouri.edu



## INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

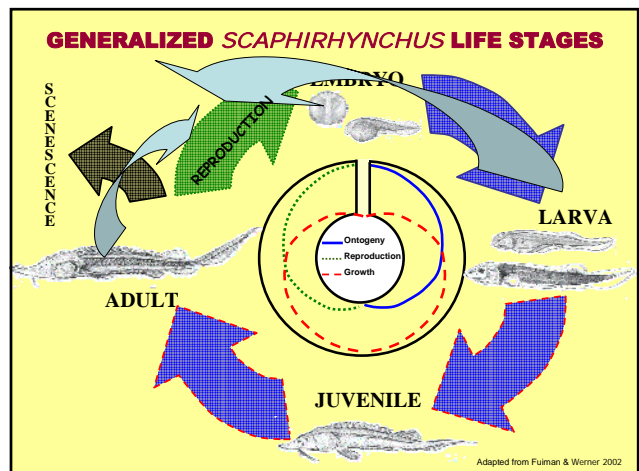
When & Where do Pallid Sturgeon Spawn?

When do *Scaphirhynchus* Sturgeon Spawn?

## INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

What Environmental Conditions Control *Scaphirhynchus* Spawning?

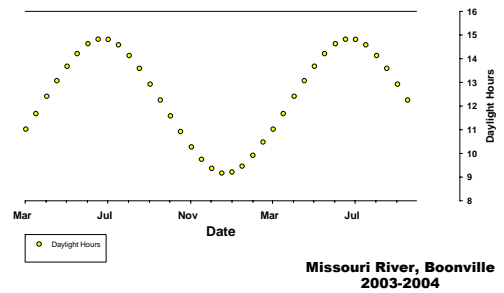
What GP Dam Flow Releases will Most Benefit Pallid Sturgeon Reproduction & Meet Other System Needs?



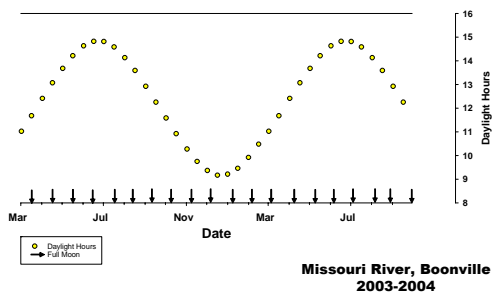
## Environmental Factors Affecting Successful Sturgeon Spawning

- Photoperiod
- Lunar Cycle
- Temperature
- River Flow

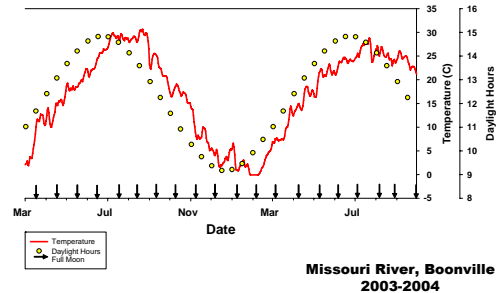
## Environmental Factors Affecting Successful Sturgeon Reproduction PHOTOPERIOD



## Environmental Factors Affecting Successful Sturgeon Reproduction PHOTOPERIOD + LUNAR CYCLE

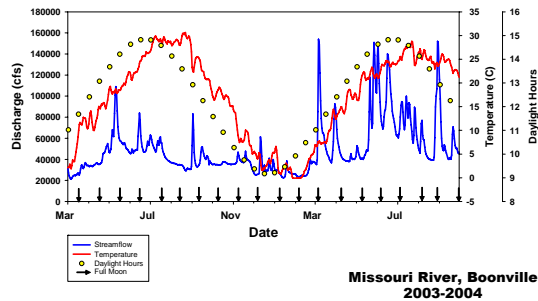


## Environmental Factors Affecting Successful Sturgeon Reproduction PHOTOPERIOD + LUNAR CYCLE + TEMPERATURE



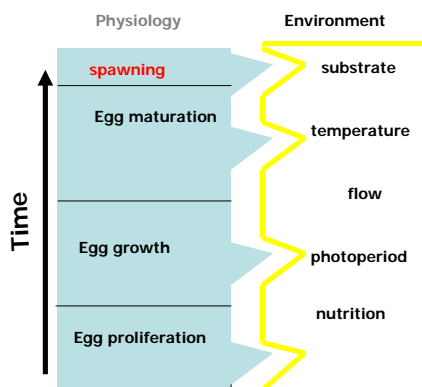
## Environmental Factors Affecting Successful Sturgeon Reproduction

**PHOTOPERIOD + LUNAR CYCLE +  
TEMPERATURE + RIVER FLOW**



## Biotic Factors Affecting Successful Sturgeon Spawning

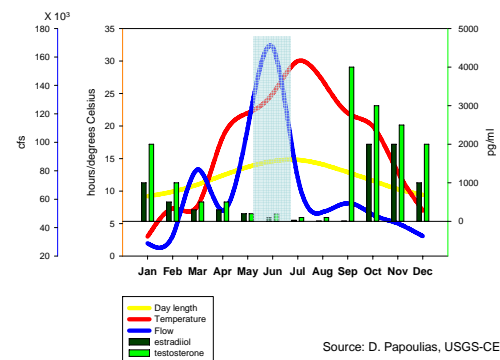
- **Age**
- **Condition**
- **Physiological State**
- **Behavioral (Social) Cues**

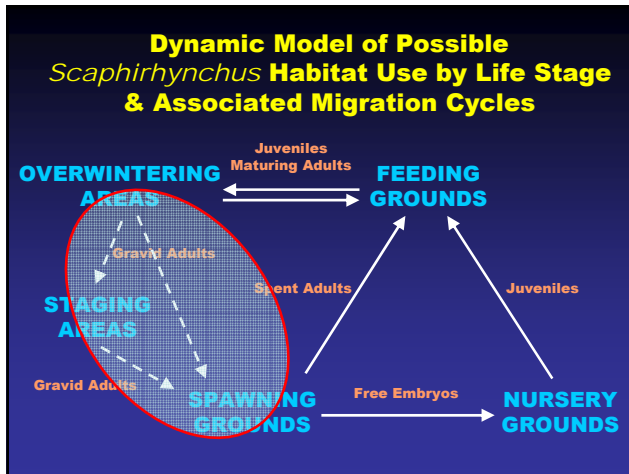


USGS

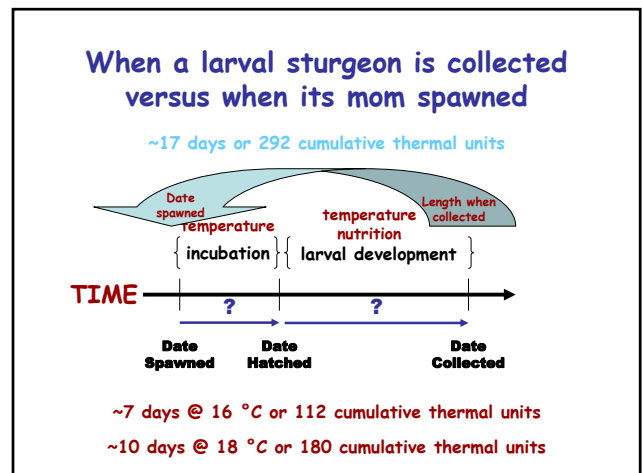
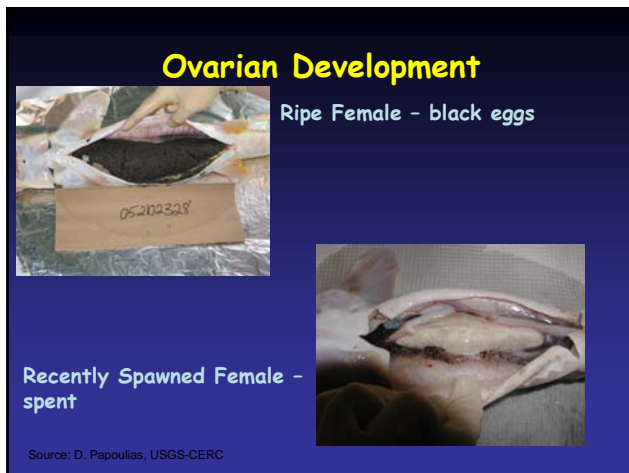
Source: D. Papoulias, USGS-CERC

## Environmental Variables Relative to Reproductive Indicators





- ### How do we know when sturgeon spawn?
- Observe spawning
  - Track reproductively mature instrumented fish
  - Ovarian development
  - Collect larvae



## Important Developmental Events for Larval Pallid Sturgeon

Source: Snyder J. Appl. Ichthyol. 2002

**Free Embryo** 8-9 mm TL, 0 D



**Protolarvae**

**Yolk Absorbed** 18-19 mm TL, ~12 D



**Mesolarva** ~25 mm TL, ~21 D

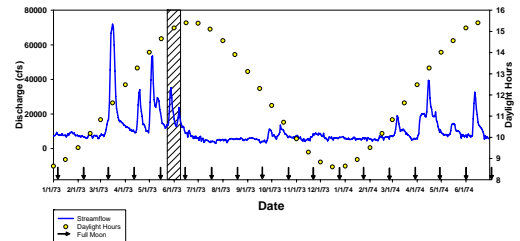


**Metalarvae** 82-138 mm, 54-92 D



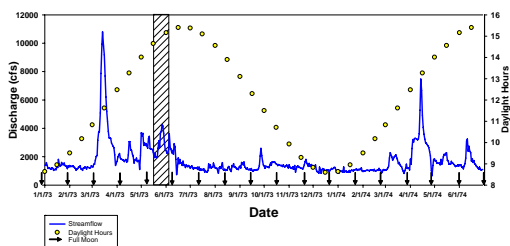
## Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River

Christenson - Chippewa River, WI

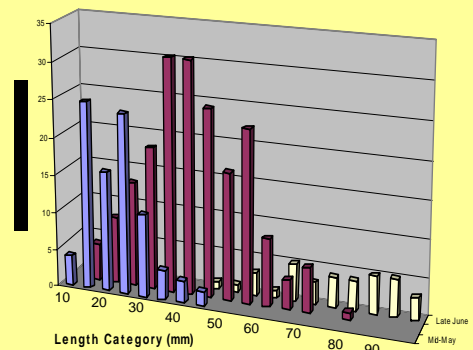


## Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River

Christenson - Red Cedar River, WI

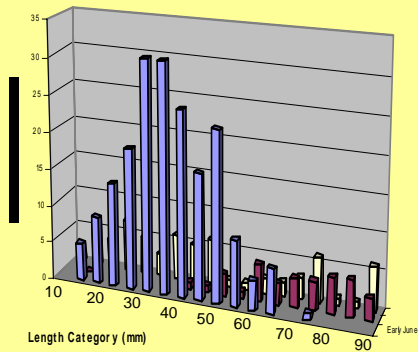


## Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Mid-May through Late-June



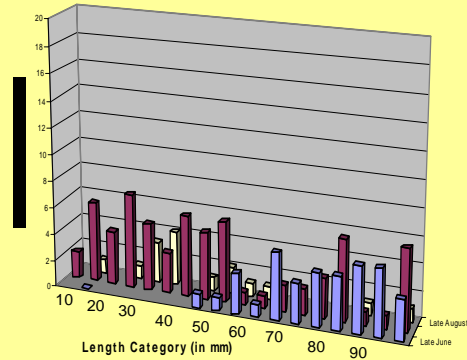
Source: D. Herzog, MDC

Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Early June through Late July



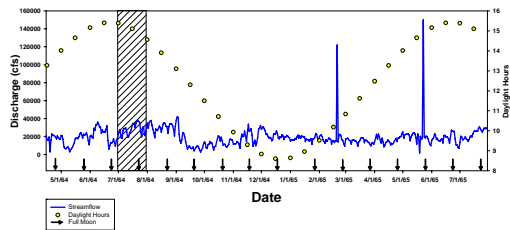
Source: D. Herzog, MDC

Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Late June through Late August



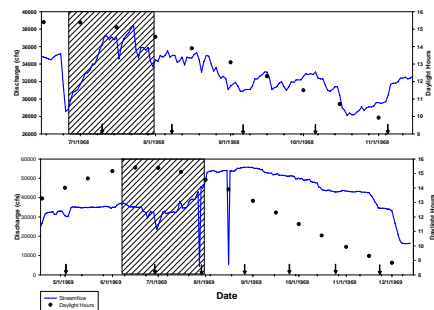
Source: D. Herzog, MDC

June – MOR, Pierre, SD, 15 April 1964 – 30 July 1965



June, F. C. Env. Biol. Fish. 2: 285-296, 1977

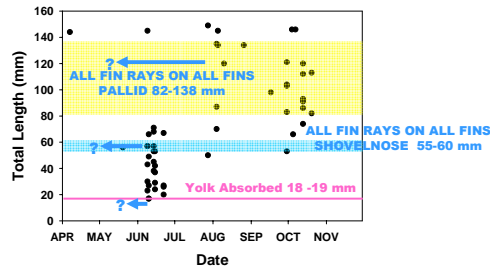
Moos – MOR, Yankton, SD, 1968 – 1969



Moos, R. E. PhD Dissertation, U. of SD, 1978

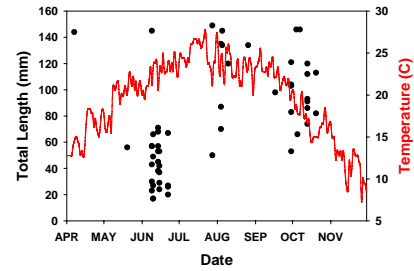
**Length-Frequency Distributions for YOY Scaphirhynchus  
Sturgeons, Lower Missouri River, MO  
USFWS Columbia Fisheries**

2004



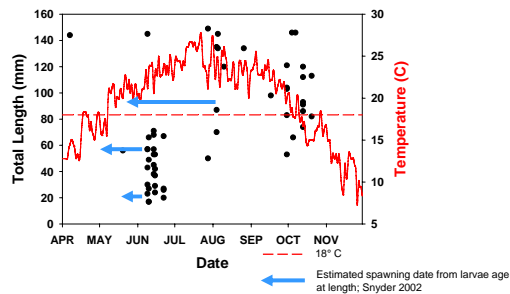
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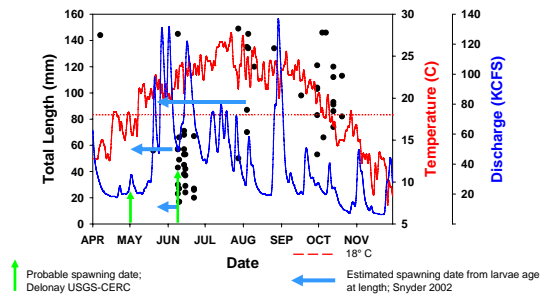
**Length-Frequency Distributions for YOY Scaphirhynchus  
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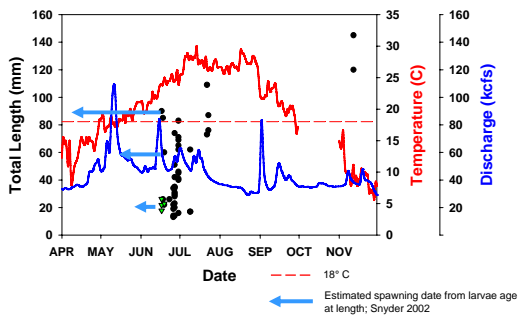


**Length-Frequency Distributions for YOY Scaphirhynchus  
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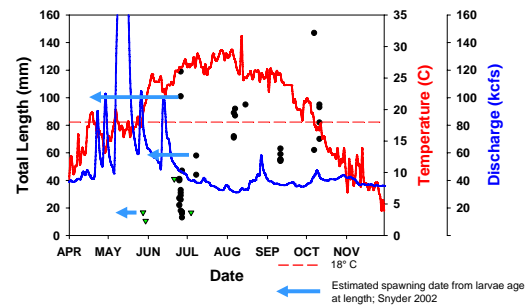
2004



**Length-Frequency Distributions for YOY Scaphirhynchus**  
**Sturgeons, Lower Missouri River, MO**  
**USFWS Columbia Fisheries – K. Reeves UMC**  
**2003**

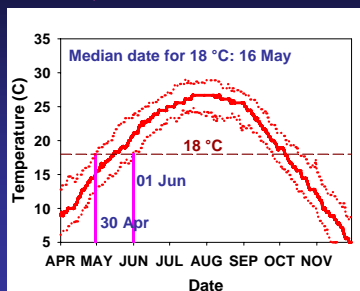


**Length-Frequency Distributions for YOY Scaphirhynchus**  
**Sturgeons, Lower Missouri River, MO**  
**USFWS Columbia Fisheries – K. Reeves UMC**  
**2002**



**What we know about Scaphirhynchus spawning**

- ~18 °C when spawning begins in lower Missouri River, Missouri



10<sup>th</sup>, 50<sup>th</sup>, 90<sup>th</sup> Percentiles of 1937-2005 Water Temperature Boonville, MO

**What we know about *Scaphirhynchus* (largely shovelnose) spawning in LMOR**

**Observations:**

- Mature females, black eggs, high GSI occur from March – August

- Duration of larvae <60 mm TL Apr – Oct

- No larvae collected at water temperature <18°C

**Conclusions:**

- Spawning does begin before June rise

- Spawning may not be flow dependent, but **successful** reproduction might be

- *Scaphirhynchus* **population** has a protracted spawning period



## Uncertainties When do pallid sturgeon spawn?

- No empirical evidence as of today of when or where pallid or shovelnose sturgeon actually spawn
- Sturgeon responses observed in highly altered Missouri River many not be normative or adaptive
- Information reported here is largely for lower Missouri River in MO, does it apply elsewhere?
- We cannot accurately separate shovelnose & pallid sturgeon larvae to refine role of flow & temperature in spawning by each species
- Is the shovelnose sturgeon an accurate surrogate for pallid sturgeon reproduction?

## Uncertainties When do pallid sturgeon spawn?

- How do flow & temperature & interact spatially to affect spawning? - longitudinal, lateral w/in main channel, main channel vs. tributaries
- How do flow & temperature & interact temporally to affect spawning? - w/in season, w/in year, among years
- How long does it take from spawn to hatch for sturgeon eggs at various river temperatures?
- What is the growth ( $\Delta$  in TL) per day for sturgeon larvae from hatch to juvenile over a range of temperatures and food rations?
- How far do larval sturgeon disperse downriver before they settle or are collected?

## Adaptive Problem Solving

